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Journal of Speech Disorders

G. OSCAR RUSSELL, Editor

SEPTEMBER 1936

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"He finds out what he cannot do
And then he goes and does it"

Years ago a scientist who shall be nameless said of Thomas A. Edison: "This poor fellow Edison is wasting his time. Two fundamental laws of physics prove that he is attempting the impossible. The first is that there can be no light without combustion. The second is that no combustion can take place in a vacuum. Therefore no light can ever be made in a vacuum.

Edison, however, proved that either he was above such laws or that the laws themselves were not fundamental. For he calmly proceeded with his experiments and produced the incandescent lamp. Harvey was scoffed at when he insisted that blood circulated through the body. It is an accepted fact now. Pasteur's theories of germ life were bitterly attacked. Today the saving of millions of lives are attributable to his discoveries. Langley showed his plans for a machine which would fly without the help of a balloon and was laughed at. Today the air is full of answers to such critics.

It has been said that a man one year ahead of his time is considered progressive. A man five years ahead of his time is considered radical and dangerous. A man twenty years ahead of his time is considered a lunatic. The answer to that lies in the benefits that have sprung from the activity of such men—benefits that could not have been conferred save by a man who lived, dreamed and thought twenty and thirty years ahead of his generation. (From Voice Writing, August, 1936)

STUDY OF THE THORACIC BREATHING OF STUTTERERS DURING EXPECTANCY AND OCCURRENCE OF STUTTERING SPASM

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Introduction: The experimental approach to the psychology of stuttering must begin by investigating the two most prominent features of the stutterer's experience: the expectancy and the experience of speech block. The present study employs the objective recording of thoracic breathing in an effort to explore these subjective states. It seeks to determine what manifestations of expectancy of stuttering or of experience of stuttering are to be found in such records.

Procedure: Although former studies of stutterer's breathing have largely confined themselves to consecutive and continuous speech, the very nature of the present problem precluded such procedure. Only one word therefore was spoken by the stutterer during a recording. The stutterer was seated before an exposure box into which he looked and waited for the word to be exposed. A Sumner pneumograph placed across the lower end of the sternum was connected with a Marey tambour mounted on the carriage of a Renshaw polygraph. The tambour worked the writing lever, a tubular straw, to which was attached a tiny cone-shaped funnel which formed the ink reservoir for the hypodermic needle writing point. This device proved to be more sensitive and much lighter than the usual ink pens available for such recording.

Three signal keys led to the standard writing pens of the polygraph. One of these was operated by the experimenter, and recorded (1) the appearance of the light which exposed the word, and (2) the disappearance of the light. The latter served as the stutterer's signal to attempt immediately to say the word. The other two keys were placed on the table below the exposure box, so that the stutterer's right hand rested on one key and his left hand on the other. He was given the following instructions:

"Upon seeing the word, decide as soon as possible whether you find yourself expecting to stutter upon it. If you are expecting to stutter, press the right hand key, then release it. If you are not expecting to stutter on it, press the left hand key. After having thus signalled whether you do or do not expect to stutter, wait for the light to be turned off. As soon as this occurs, you are to attempt

the word immediately. The moment you attempt the word, press down the right hand key and keep it down until the word is pronounced."

After a short period of training in the above sequence of (1) exposure, (2) decision signal, (3) turning off of light, and (4) duration of speech attempt signal, the stutterers were able to react efficiently. A typical record is given below. The examiner wrote the word and any other pertinent comments on the records before proceeding to the next exposure. The words used were familiar. Each was typewritten in the center of a card which was inserted into a frame at the back of the exposure device before the light which made it visible was turned on.

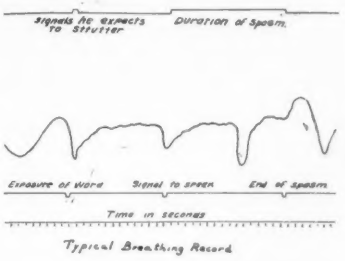

FIG. 1

Forty-three stutterers were tested according to the above procedure. However, many of them either did not stutter at all or adapted so rapidly to the experimental conditions that the number of usable records totalled thirty-seven. The experiments were conducted at the speech clinics of the Universities of Iowa and Minnesota.

Results and Discussion: Since these data throw light upon several problems, they will be so treated here.

RELATIONSHIP BETWEEN EXPECTANCY AND OCCURRENCY OF STUTTERING

There is a widespread belief that the correlation between expectancy and occurrence of stuttering is very high and indeed it has been earnestly advocated by many that the relationship is one of cause and effect. The so-called fear of stuttering is frequently cited as a causal, if not the causal factor in stuttering. When analyzed, the term "fear of stuttering" seems to include at least two components: expectation and unpleasantness, the latter having reference either to the feeling of exhibiting behavior abnormalities subject to social stigma or to the experience of being thwarted in a goal achievement (communication). In this experiment, there was no control of the latter component except insofar as the experimental situation did remain constant.

As was expected, a great amount of variability from stutterer to stutterer was found, not only in terms of frequency of expectancies or of what words produced them, but also in the relation between expectancy and occurrence of stuttering block.

The frequency of expectancies was cast in the form of percentages of total number of words exposed. These results are as follows:

2 stutterers expected to stutter on at least 90% of the exposed words; 5 on 80%; 11 on 60%; 12 on 50%; 18 on 40%; 22 on 30%; 29 on 20%; 31 on 10%; 32 on 5%; and 37 on from 1% to 5%. The data, then, indicate pretty well that individual differences do exist; and it was the experimenter's opinion that these differences corresponded to the average severity of the stutterer's spasms in oral reading.

The relationship between expectancy and occurrence of stuttering (Exp. and St.) is expressed in the following table. In this part of the experiment, records of only twenty-one of the stutterers were used, since the others did not stutter sufficiently to provide the required minimum of 10 spasms.

TABLE I

RELATIONSHIP BETWEEN NUMBER OF STUTTERING BLOCKS AND EXPECTANCIES

	Total	No. of Stutterers Showing no Examples	No. of Changes of Decision	Average Decision Time
Exp. and St.....	238	——	8	2.0 sec.
Exp. but no St....	48	5	15	2.5 sec.
No. Exp. and no St.	250	——	12	1.5 sec.
No Exp. but St...	17	12	7	2.5 sec.

As the table indicates there was a total of 238 words on which the stutterer signalled expectancy and 250 words on which no expectancy was signalled. Many stutterers had more non-expectancies than expectancies but in order to prevent undue weighting of the results in favor of one stutterer's performance only the first 10 to 15 of those appearing on the record were used.

Whenever expectation was followed by no stuttering (or no expectation was followed by stuttering), the stutterer was asked whether expectation had not occurred (or had not disappeared) during the interval between his decision and the signal to speak. These results are given in the third column of Table I. These reports may be subject to a certain error but most of the stutterers (11 out of 13) refused to accede to the suggestion that such changes of decision accounted for all the times when no expectancy was followed by block or vice versa. Surprise as a reaction to the experience of block was reported in 10 of the 17 cases in which no expectancy had occurred. Only five of the stutterers stuttered every time when they expected to do so. Eleven of them stuttered at times when they had no expectancy of block. Expectancy therefore did not always guarantee stuttering, nor lack of expectancy freedom from block. Changes in decision could not account for all these discrepancies between expectancy and occurrence of stuttering.

The decision time was the interval between the exposure and the decision as to whether expectancy was present or not. One would expect that in cases where the expectancy was unsure, long decision times would be the rule. That no such results markedly occur seems

to add weight to the conclusion that occasionally stuttering spasms can take place without being preceded by any mental state vivid enough to be called fear or even expectancy of stuttering. However, such a conclusion does not apply to the thesis that subliminal cues in sound sequences or semi-forgotten word associations may be responsible for the precipitating of the stuttering reaction. It may be that, in these cases, serial conditioning had caused the middle term (conscious expectancy) to drop out and that now the cue could set off the reaction by its own efficacy and without any awareness. At any rate, it is significant that even under these very favorable conditions for self scrutiny, stuttering could occur without observable awareness of expectancy.

BREATHING CHANGES DURING EXPECTANCY

It was next necessary to examine the records to determine whether the breathing curves taken during the interval between exposure and the expectancy signal differed from those of intervals between exposure and the non-expectancy signal. Similarly, the intervals between decision signal and speech attempt were studied for both expectancy and non-expectancy records. Several investigators, notably Fletcher (1) and Robbins (3) had testified that distinct abnormalities were found prior to speech attempt and were significant of the emotional state responsible for the behavior. The normal inspiration-expiration ratios for each stutterer were determined from an analysis of 10 consecutive curves of silent breathing in terms of amplitude and duration, using the method described by Fossler (2). Then the curves immediately preceding and succeeding each decision signal were similarly measured. All irregularities were noted. The results of this analysis are given in Table II.

TABLE II

AVERAGE OF THE INSPIRATION-EXPIRATION RATIOS DURING EXPECTANCY AND NON-EXPECTANCY

	Expectancy		Non-Expectancy		Normal Breathing	
Number of words.....	286		267		210	
Pre-decision	Average	S.D.	Average	S.D.	Average	S.D.
Inspiration-Expiration ratio duration.....	1.45	.23	.91	.17	.97	.08
Inspiration-Expiration ration amplitude.....	.89	.27	.97	.13	.98	.11
Total number of irregularities.....	.53	....	.8			
Post-decision						
Inspiration-Expiration ration duration.....	.94	.22	.69	.22		
Inspiration-Expiration ration amplitude.....	.85	.28	.56	.27		
Total number of irregularities.....	72	....	11			

As the table shows, most of the words on which expectancy of block occurred could be distinguished from those which were not feared by the Inspiration-Expiration duration ratio existing immediately subsequent to the exposure of the word. The stutterer saw the word; some cue then set off the expectancy, either the association with past stuttering experience of the first letter, or the meaning of the word, or the word as a word. As this occurred, he prolonged his inspiration, not necessarily taking a deeper breath, but merely taking longer to achieve the usual inflation.

When, on the contrary, the word was not feared, expiration was slightly longer in duration and the amplitudes of inspiration and expiration were approximately equal. It is interesting that the duration of expiration during non-expectancy should be longer than in normal silent breathing. This, it is felt, is to be explained in terms of the relief and definite ease felt when the exposed word was seen as "easy."

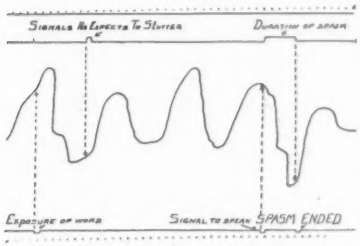

FIG. 2

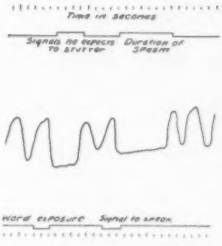

FIG. 3

Following the decision, the differences between expectancy and non-expectancy are not so clear, although their direction is the same as for pre-decision states having I/E (inspiration-expiration) duration ratios of .94 and .69 for expectancy and non-expectancy respectively. It is felt that some of these relatively long expiration times were due to the stutterers awaiting the signal to speak. When the I/E ratios made by the individual stutterers were studied, it was clear that, although an expectancy decision usually followed a long inspiration, there were a few exceptions to this rule in all but 2 stutterers. However, only one stutterer had more than 5 per cent of his expectancies preceded by a low I/E ratio for duration. Since the consistently low I/E duration ratios for the non-expectancies showed an opposite trend, it is felt that the use of the I/E duration ratio as a criterion of expectancy of stuttering under these experimental conditions is justified when enough samples to overweigh the possibility of exception-error are used.

The I/E ratios for amplitude show a much greater expiration during the post decision period for the non-expectancy words. The same trend holds true, but to a less degree for the expectancy words. This is probably due to the use of some of the residual air in awaiting the speech attempt signal.

The variability of breathing during expectancy is seen to be much greater than during non-expectancy. And the number of irregularities, ranging from spasmodic gasps to prolonged holding of the breath with rapid tremors, was much greater. These irregularities were not incorporated in the I/E measurements, because of their obvious distortions. Usually they were rehearsals of the breathing abnormality found during spasm. Certain stutterers had none at all, others consistently showed them in their breathing. More of these rehearsals and irregularities occurred subsequent to the decision. Examples are to be seen in Figs. 1, 2, and 3.

The existence of these rehearsals of breathing abnormalities during silence and prior to speech attempt are of important theoretical significance in suggesting that they are the objective evidences of a definite preparatory set to stutter in a stereotyped manner. Of the stutterers used in the investigation, 16 showed two or more of these spasm rehearsals. One individual rehearsed consistently on every feared word. Others reported that they made rehearsal movements with lips, jaw and tongue which did not show up in the records. Others were unaware that they had made any rehearsals. At times (9 out of 51) these rehearsal irregularities were identical with the actual spasm irregularities; usually there were differences in amplitude and duration, which prevented any exact correlation but which did not deny the resemblance in inspection. In 33 of the 51 rehearsals the subsequent breathing curves returned to normal prior to the speech attempt (see Fig. 3). Most of these (38 of the 51) rehearsals appeared in the post-decision period, due probably to the stutterers usually short decision times. At no time was rehearsal followed by no spasm.

If indeed the form of the spasm is determined by the preparatory set, the possibilities of modifying the latter becomes of immense importance in therapy. It also would seem to account for the compulsive feature of the stutterer's symptoms, for their common testimony that they "cannot help stuttering like that."

RELATIONSHIP BETWEEN EXPECTANCY BEHAVIOR AND DURATION OF STUTTERING SPASM

When an attempt was made to correlate the value of the pre-decision I/E ratios with the duration of the spasm which followed them the correlation by the Pearson Product moment method was found to be .13 ± .04.

TABLE III

RELATION BETWEEN I/E DURATION RATES AND DURATION OF SPASM

	Pre-Decision	Post-Decision
I/E and Spasm Duration (233 Spasms)...	.13 ± .04	.07 ± .05
$\frac{D}{\text{Diff.}}$ (20 long and 20 short spasms).....	2.8	1.0

However when the twenty longest spasm (all having durations of 15 seconds or more) were compared with the twenty shortest spasms (of 1 second or less) statistically significant differences in the pre-decision I/E ratios were found, the averages being 1.67 and 1.13 respectively with a critical ratio $\frac{D}{\delta \text{ Diff}}$ of 2.8.

The post decision breathing abnormalities do not seem to have as much relationship to the duration of the stuttering spasm as evidenced by the second column of Table II. Nevertheless the relationship as demonstrated by the critical ratio is positive in sign. Thus one can say that the duration of the stuttering block bears some relationship to the amount of change in the I/E ratio during the expectancy period. The relationship however is not sufficiently high save in extreme cases for use as a predictive tool. These results indicate that the stutterer's expectancy plays some part in determining the duration of his stuttering spasm, a finding of immediate importance to therapy, but exactly what part it does play is not demonstrated by this experiment. Further research intended to investigate the correlation between spasm duration and subjective estimate of stuttering expectancy will doubtless throw more light upon this problem.

Decision time, another measure of expectancy behavior, was compared with spasm duration. This was done on the chance that the time taken to decide whether the word would probably be stuttered on, could serve as a measure of amount of expectancy. Long decision times should have meant uncertainty and short ones certainty of stuttering expectancy. However, no relationship was found, probably due to the fact that there were few long decision times, (the average being 2.4 seconds, with an S. D. of 1.2), and a great many factors related to set and attention which could cause variability in the reaction time to exposure. One case showed a very high relationship but all others did not. The correlations of the whole group of spasms as well as of the individual stutterers were negligible, and the use of the method of extreme cases showed no trend in the direction of a positive relationship.

The reliability of the measures of spasm duration was determined in two ways: (1) by correlating the duration of the stutterer's depression of his signal key with the duration of breathing abnormality and (2) by having the experimenter press his key at the beginning and

termination of speech attempt. It was found that while some individuals were less accurate than others, the error never exceeded one second, an amount which was negligible in view of the average duration (4.6 sec.) of the spasms, only 2 times out of the 50 spasms checked. The preliminary period of training mentioned earlier in the paper was probably responsible for this accuracy.

BREATHING ABNORMALITIES DURING EXPERIENCE OF STUTTERING SPASM

When the signal to attempt the feared word was given a great many bizarre breathing disturbances resulted. These have been previously described by several investigators, notably those of Ten Cate (5), Fletcher (1), Robbins (3), and Fossler (2). Fossler's (2) careful study of the 13 stutterer's breathing during consecutive speech may be mentioned. He found as did the other investigators that some stutterers had typical and characteristic patterns of breathing abnormality. However, he concluded that these were unrelated to any particular sounds and that no breathing abnormality characteristic of the disorder could be said to exist.

In general our research has borne out his conclusions. All the forms of abnormality found by Fossler together with many other varieties appeared in the records.

The following data is of interest: of the 37 stutterers only six showed stereotyped breathing abnormalities on all words. These six stuttered very consistently and characteristically on all words whether they began with a vowel or consonant. Fourteen stutterers showed consistent and characteristic breathing patterns on words beginning with the same sound or syllable. Four other stutterers seemed to have two characteristic breathing patterns during spasm, one of which was invariably tried first. When this did not result in release the second pattern followed it. Other stutterers seemed to have a large variety of patterns which defied analysis in terms of phonetics or muscle action.

Certain of the stereotyped patterns were undoubtedly merely the by-products of release or interruptor devices used deliberately or habitually by the stutterer to free himself from a block. The use of a sudden gasp to interrupt a long tonic block produced one such pattern. Timing devices such as three-count panting or rhythmic tongue and lip movements often produced characteristic abnormalities in the breathing records. Certain stereotyped devices to get on the speech attempt started, such as coughing, sucking, or exhalation as in speaking on residual air, all caused great variations in the normal breathing. It was impossible to quantify these observations but the experimenter offers on the basis of his observation the thesis that most of the breathing abnormalities found in stuttering spasm, can be explained as being due to the methods used by the stutterers in reacting to expectancy and experience of block. The two most com-

mon reactions, forcing and retrial, affect not only the articulation but many other functions as well. Too many investigators of the problem of stuttering have ignored the fact that breathing abnormalities should not be studied separately but always in relation to other purposive behavior. The thesis that breathing abnormalities are entirely due to a competition between cerebral and lower neurological levels seems rather far-fetched.

Two stutterers consistently showed interesting repetitions of the same pattern within the same spasm, and eight others showed occasional examples thereof. This circular response seemed to continue until release was achieved. Release seemed to occur at the same phase of the abnormal breathing pattern, otherwise the whole pattern was repeated or supplemented. All the stereotyped breathing patterns demonstrated this time characteristic of release. There were never any characteristic patterns interrupted before completion.

CONSISTENCY AND CHARACTERISTICNESS OF BREATHING ABNORMALITIES IN STUTTERING

The part played by habit in stuttering (or stammering) has never been satisfactorily determined although much controversy has centered about this very problem. That it has some influence on the handicap, nearly all authorities would agree. Not many of these authorities believe that this influence would extend to the function of breathing and account for abnormalities found therein during stuttering spasm. However, in view of Van Riper's (1) study of the testimony of stutterers concerning their adoption of postponement, initiatory, and interruptor devices, many of which were certain to affect respiration, and in view of the number of stutterers reporting that these devices had become habitual, and largely uncontrollable, it seemed necessary to attack the problem.

If many of the abnormalities shown in the breathing of stutterers during spasm are due to habit, then the first test of such a hypothesis would be found in the consistency of such abnormalities. One important criterion of a habitual response is its stereotyped sequence of movements, its consistency of performance. A second such criterion would require that the response be more or less characteristic and that it could be distinguished from the consistent spasm patterns of other stutterers. If such characteristics can be shown, it would tend to support the view that the particular devices adopted and made habitual by the stutterer are the factors which account for the abnormal breathing pattern.

Although the common opinion is that these disturbances in breathing are the chaotic and disorganized results of emotional upheaval or the results of breakdown in the functioning of the normal integrating centers, certain evidence does exist to the contrary.

Fletcher (1) noted that there are some stereotyped patterns of breathing abnormality for individual stutterers. Robbins (3) con-

cluded that every stutterer has a characteristic way of breathing while stuttering. Fossler (2), on a careful study of 13 stutterers, reported finding observable, typical, recurrent patterns. However, he stated that these were not definitely associated with attempts at the production of any particular sound or group of sounds, and further noted that there were a few individuals who showed characteristic patterns of breathing abnormality consistently. Travis (4) showed a marked lack of correspondence between thoracic and abdominal breathing during stuttering, and termed the phenomena to be evidence of "dysintegration," rather than of "disintegration" because of the possibility that abnormal integrations were involved.

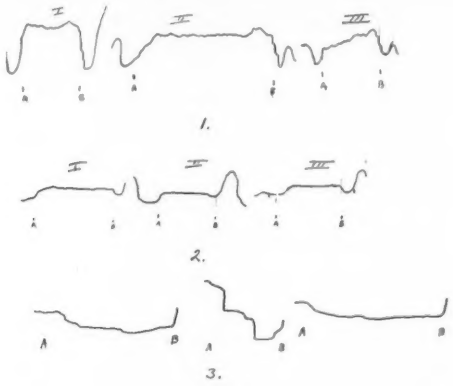

FIG. 4

All of these studies required the stutterer to use continuous speech and only in Fossler's study was a record kept of the particular word stuttered upon.

In order to determine whether the breathing patterns which had seemed to us to be stereotyped were so we attempted a mathematical treatment of the curves but because of the variation in duration and amplitude which so often occurred, this method was discarded for that of controlled inspection.

As mentioned earlier in the paper, fourteen stutterers showed seemingly stereotyped breathing abnormalities on words beginning with the same sound or syllable. We were able to get three samples of stuttering on the word "be" from ten of these cases. The breathing curves during spasm were then traced and the tracings pasted on individual cards. The cards were then numbered, shuffled, and sample curves from each of the ten stutterers were lined up on a table. Fifteen graduate students and members of the faculty of the Univer-

sity of Iowa were requested to match the remaining 20 cards with the samples, using the method of paired comparisons. The results were as follows:

Seven of the ten sets (see Figs. 4 and 5) were matched by all fifteen observers without error. The eighth set was judged correctly by 13 observers; the ninth by 10 observers, and the tenth by 9 observers.

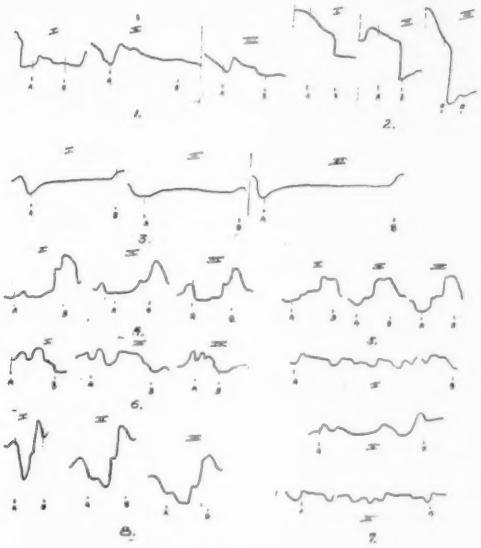

FIG. 5

These results are the more striking in view of the differences in amplitude and duration which did distort the shape of the curves somewhat. Two things are clear: (1) that certain stutterers do have such consistent and characteristic breathing patterns during stuttering block that an explanation of these reactions on the basis of habit seems mandatory and (2) that for some reason or other it is possible to stutter in many different ways. With regard to the latter conclusion we might cite breathing records obtained on two young children, who as far as the parents or the examiners could determine, were not aware of their stuttering. These children showed no breathing abnormalities whatever. Their spasms were of the short clonic variety and they did not seem to react to their blocks with any noticeable forcing or grimaces.

It should be made clear that although certain stutterers seem to have stereotyped spasm patterns which affect their breathing, it does not necessarily follow that stuttering is nothing more than a bad habit. Most of the modern research in the field tends to deny such a supposition. However, when blocks frequently occur in the forward flowing sequence of speech, the individual experiencing them is going to react to them, and during a lifetime of such experiences would tend to build up patterns or habits of reaction—both to their occurrence and expectancy.

SUMMARY

The study of the stutterer's breathing during expectancy and experience of speech block while pronouncing individual words resulted in the following findings:

1. There are individual differences in the consistency with which expectation of block is followed by occurrence of block. Generally, there is a high correspondence.
2. Stuttering spasms can occur without being preceded by expectancy.
3. Expectancy of stuttering can occur without being followed by stuttering.
4. Expectancy of stuttering tends to reflect itself in a high Inspiration-Expiration ratio, in increased variability, and in the appearance of breathing irregularities.
5. Definite rehearsals are found during the period of expectancy which have the same form of breathing abnormality as that occurring during stuttering speech attempt. Their significance as possible preparatory sets which determine the form of the overt spasm is discussed.
6. The abnormalities of breathing during overt spasm and the influences of reaction devices upon them are described.
7. Certain stutterers present stereotyped breathing abnormalities which are both characteristic and consistent. Their similarity to habitual reactions is presented.

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SURVEY OF SPEECH DEFECTS AMONG PUBLIC SCHOOL CHILDREN OF INDIANA

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Submitted thru the interest of Prof. Max T. Steer, Purdue University

The report of the Committee on Speech Handicaps of the White House Conference[2] includes data from a questionnaire survey of speech defects of school children in cities over 10,000 population. The incidence in 48 cities reporting ranged from 0.5 per cent to 21.4 per cent with a median of 6.9 per cent. If the populations surveyed are added together and a new incidence calculated it is found to be about 5 per cent. These data include all types of defect, and as far as can be determined from the report the criteria of judgment varied from city to city. Therefore, we can take five per cent as a conservative estimate of the incidence of speech defects in urban school children.

In our report there are no data from a single one of the 33 cities in Indiana with a population over 10,000. This lack must be ascribed to the negligence of the Indiana school cities rather than to the perfection of speech sounds used by Indiana children. Work in speech correction carried on for a number of years by Mrs. E. C. Halls at the Indiana University Psychological Clinic at the James Whitcomb Riley Hospital for Children made us acutely aware that this State had its full share of the speech problem. On the other hand, because of the very meagre attention being paid to the problem in the State[3] it appeared that few realized its seriousness. Therefore, Mrs. Halls proposed that the Psychological Clinic undertake a survey of speech defects throughout the whole State.

The only practical method of securing data in such a survey is by means of a questionnaire. The instrument used by us was a one page blank in which the school principal was asked to enter by

[1]Publications: Indiana University Psychological Clinics, Series II, No. 13.
[2]White House Conference on Child Health and Protection. Sect. III F. Committee on Special Classes. *Special Education. The Handicapped and the Gifted.* New York, Century. 1931, 604 p.
[3]At the present time Professor Max T. Steer, of Purdue University, is investigating the extent of existing facilities in the school systems of the State.

grades and by sex the total enrollment, the number of stutterers, the number of children with cleft palates, and in a third column, the number of children with speech defects not included under either of the other two headings. Through the generous co-operation of Mr. Floyd McMurray, State Superintendent of Education, these blanks were sent via the county and city superintendents to the principals of all of the 3,717 public schools of the state. From these 1,223 blanks were returned from schools with a total pupil population of 315,353. As was to be expected not all of these blanks were in usable form. Reports from 63.5 per cent (199,839 pupils) of the total pupil population included were complete, i. e., they were properly distributed by grade and by sex. Data from complete blanks only are used in the present paper.

We have no means of demonstrating the reliability of our data. The teacher's judgment is the basis of the raw figures, so that our whole analysis must rest on this somewhat insecure foundation. Where reports were obviously in error, as one school with 16 pupils which reported 16 stutterers, or another of 64 pupils with 35 cleft palates, they were eliminated. In a population of nearly 200,000 it is probable that chance errors in teachers' observations are ironed out. In any case, the analysis below, gives at least a conservative picture of conditions.

Another question demanding attention is the adequacy of our sampling. In Indiana there are two sorts of school organizations, viz., the county systems including all rural schools, and the city and town school corporations ranging in pupil population from 28 to 62,073. Obviously the corporations at the lower end of the range cannot be called urban. Therefore, we selected a census enumeration of about 2,000 as an approximate lower limit for urban communities. There were 104 such school cities from 51 of which we received reports for all or a part of their schools. From the 92 county systems we received reports for all or a part of the schools in 54. The total number of children covered in complete reports was 199,839, or 28.77 per cent, of the 694,428 children enrolled during the year 1934–1935. There was a good geographic distribution as only 20 counties scattered throughout the state failed to file reports for city or county systems or both. It would thus appear that our sample is sufficiently large and well distributed to be representative.

RESULTS

The material we have available lends itself to extensive analyses of greater or lesser significance, but in this paper we must limit ourselves to presentation of the basic data, and to pointing out some of the more evident comparisons. In order to avoid partial duplication of tabular material we are presenting the major portion of our data in Tables 1 and 2 upon which the subsequent discussion will be based.

Table 1, county systems, includes data from 54 of the 92 county systems and may be taken as representing a rural population. Table 2, city systems, includes data from 51 to 104 city school corporations selected as previously described. In both tables the enrollment figures are those reported on our questionnaire blanks. Figures for the first grades have been divided into "new first grade" or entering 1-B, and all other children either repeating 1-B or in 1-A. While our blanks asked for data on the number of children with cleft-palates we have not isolated this group in our tables. The data clearly indicated that many teachers could not recognize cleft-palates—or more exactly they recognized too many. The reports gave an incidence of 0.4 per cent cleft-palates which is evidently erroneous when one contrasts it with the usually accepted medical statistics of one cleft-palate per 1,500 to 2,000 live births. As the numbers were small, and as it is most probable that all of these children had some articulatory defect we have added these cases to the other articulation group.

Gross incidence of defects.—Of the 199,839 children enrolled in schools returning complete blanks, 7,398 were reported to have defective speech. This is a gross incidence of 3.7 per cent, which is only 1.3 per cent less than the gross incidence calculated for the cities reporting to the White House Conference Committee. As our data are based entirely upon the judgments of classroom teachers this figure must be taken as a very conservative estimate. It does, however, represent a very probable minimum. If this percentage holds for the total school population of the State it means there are 25,394 children in the public schools of the state whose speech is so imperfect that they need special attention.

Types of defect.—Our questionnaire asked teachers to give the number of children who stuttered, who had cleft palates, and who had any other type of articulatory disorders. Of the children reported to have any sort of defect 79 per cent had articulatory disorders and 21 per cent were stutterers. These figures represent a gross incidence in the total population of 2.93 per cent articulatory and 0.77 per cent stuttering.

Urban vs. rural schools.—The gross incidence of all types of defects in the county systems which represent rural areas was 4.3 per cent, while in the city systems the incidence was 3.3 per cent. Owing to the large population involved this difference of only one per cent is statistically significant, being considerably greater than three times its own probable error. The ratio of incidences, county/city, is 1.29 for all defects. A similar ratio for articulatory defects alone is 1.33, and for stuttering is 1.17. This would indicate that articulatory defects constitute a slightly greater proportion of all defects among rural children than they do among city children.

TABLE

BASIC DATA FROM 54

The Distribution and Number of Cases

School Enrollment			Articulatory			Stuttering			Totals		
Boys	Girls	Total	B	G	T	B	G	T	B	G	T
2761	2522	5283	317	184	501	46	17	63	363	201	564
1258	990	2248	149	87	236	21	2	23	170	89	259
3604	3084	6688	286	174	460	52	18	70	338	192	530
3702	3352	7054	193	111	304	44	17	61	237	128	365
3713	3488	7201	177	116	293	60	22	82	237	138	375
3754	3391	7145	126	60	186	51	21	72	177	81	258
3597	3236	6833	94	65	159	47	18	65	141	83	224
3511	3445	6956	76	38	114	49	13	62	125	51	176
2358	3091	5449	51	37	88	33	12	45	84	49	133
2451	2405	4856	24	12	36	14	5	19	38	17	55
2034	1892	3926	13	15	28	18	5	23	31	20	51
1755	1813	3568	10	5	15	10	4	14	20	9	29
1535	1448	2983	6	8	14	14	2	16	20	10	30
36033	34157	70190	1522	912	2434	459	156	615	1981	1068	3049

TABLE

BASIC DATA FROM

The Distribution or Number of Cases

School Enrollment			Articulatory			Stuttering			Total		
Boys	Girls	Total	B	G	T	B	G	T	B	G	T
3701	3392	7093	364	237	601	36	16	52	400	253	653
4061	3698	7759	280	218	498	41	9	50	321	227	548
6711	5313	12024	375	245	620	91	20	111	466	265	731
6242	6490	12732	321	211	532	74	23	97	395	234	629
6410	6597	13007	222	119	341	69	29	98	291	148	439
6512	6405	12917	142	108	250	75	27	102	217	135	352
6353	6275	12628	112	70	182	68	16	84	180	86	266
5398	5418	10816	88	54	142	60	21	81	148	75	223
4841	4924	9765	49	31	80	41	8	49	90	39	129
5160	4132	9292	25	12	37	57	22	79	82	34	116
3888	3766	7654	20	13	33	38	15	53	58	28	86
3332	3162	6494	10	11	21	20	5	25	30	16	46
3320	3290	6610	11	6	17	18	5	23	29	11	40
65929	62862	128791	2019	1335	3354	688	216	904	2707	1551	4258

NUMBER 1

COUNTY SCHOOL SYSTEMS

Percentage Distribution of Cases

Articulatory			Stuttering			Totals			
Boys	Girls	Total	B	G	T	B	G	T	Grade
11.45	7.30	9.50	1.67	0.67	1.19	13.12	7.97	10.7	New 1
11.85	8.80	10.50	1.67	0.22	1.02	13.52	9.02	11.5	1
7.95	5.65	6.89	1.44	0.58	1.05	9.39	6.23	7.9	2
5.21	3.32	4.30	1.19	0.51	0.86	6.40	3.83	5.2	3
4.77	3.32	4.07	1.62	0.63	1.14	6.39	3.95	5.2	4
3.36	1.77	2.61	1.36	0.62	1.01	4.72	2.39	3.6	5
2.62	2.01	2.33	1.31	0.55	0.95	3.93	2.56	3.3	6
2.16	1.10	1.64	1.40	0.38	0.89	3.56	1.48	2.5	7
2.16	1.20	1.62	1.40	0.39	0.83	3.56	1.59	2.5	8
0.98	0.50	0.74	0.57	0.21	0.39	1.55	0.71	1.1	9
0.64	0.79	0.71	0.89	0.26	0.58	1.53	1.05	1.3	10
0.57	0.28	0.42	0.57	0.22	0.39	1.14	0.50	0.8	11
0.39	0.55	0.47	0.91	0.14	0.54	1.30	0.69	1.0	12
4.23	2.67	3.47	1.27	0.46	0.88	5.50	3.13	4.3	Total

NUMBER 2

51 CITY SCHOOL SYSTEMS

Percentage Distribution of Cases

Articulatory			Stuttering			Total			
Boys	Girls	Total	B	G	T	B	G	T	Grade
9.82	7.00	8.49	0.97	0.47	0.73	10.79	7.47	9.2	New 1
6.89	5.91	6.41	1.02	0.24	0.64	7.91	6.15	7.1	1
5.58	4.61	5.15	1.35	0.38	0.92	6.93	4.99	6.1	2
5.15	3.26	4.18	1.19	0.35	0.76	6.34	3.61	4.9	3
3.46	1.81	2.62	1.07	0.44	0.75	4.53	2.25	3.4	4
2.18	1.69	1.93	1.15	0.42	0.79	3.33	2.11	2.7	5
1.76	1.11	1.44	1.07	0.25	0.67	2.83	1.36	2.1	6
1.63	1.00	1.31	1.11	0.39	0.75	2.74	1.39	2.1	7
1.01	0.63	0.82	0.85	0.16	0.50	1.86	0.79	1.3	8
0.48	0.29	0.40	1.10	0.53	0.85	1.58	0.82	1.2	9
0.51	0.35	0.43	0.98	0.40	0.69	1.49	0.75	1.1	10
0.30	0.35	0.32	0.60	0.16	0.38	0.90	0.51	0.7	11
0.33	0.18	0.25	0.54	0.15	0.35	0.87	0.33	0.6	12
3.06	2.12	2.61	1.05	0.34	0.75	4.11	2.46	3.3	Total

Sex differences.—In both city and county schools a larger percentage of boys than of girls were reported to have defects. The ratio of boys' incidence to girls' incidence are as follows:

	Articulatory	Stuttering	Total
County	1.58	2.76	1.75
City	1.44	3.09	1.67

The contrast between the ratios for articulatory disorders and stuttering is interesting. While articulatory defects are about one and a half times as frequent among boys, stuttering is three times as frequent. This great difference has been reported by West,[4] and in both his study and in ours it is found that this high ratio is consistent throughout the grades. The ratios found in both studies are shown in Table 3. These sex differences, which are too great to be due to chance have not been satisfactorily explained. Unfortunately our data can offer nothing toward an explanation.

TABLE 3

SEX RATIOS AMONG STUTTERERS[5]

Grade	Boys to One Girl	
	West	Indiana
I	3.1	3.3
II	3.4	3.8
III	3.6	3.0
IV	4.2	2.5
V	4.2	2.6
VI	4.0	3.4
VII	4.8	3.2
VIII	3.7	3.7
IX-X	3.7	2.7
XI-XII	5.5	3.9

Race differences.—The data presented in Tables 1 and 2 include both white and colored children; however, as we asked each principal to indicate whether his school was for white children only, for mixed races, or entirely for negroes we were able to isolate the race factor. For economy only the most pertinent data for city schools are shown in Table 4. The difference between white and negro schools is only 0.22 per cent. If we add the mixed schools to the white schools the percentage of defects is only 3.18 or a difference from negro schools of only 0.08 per cent. This small difference indicates a slightly greater frequency of defects among whites than negroes,

[4]WEST, ROBERT. *The phenomenology of stuttering.* In *A Symposium on stuttering.* (Ed. by R. West.) Madison, Wis., College Typing Co., 1931. Pp. 1–6.

[5]Table LXIII from Loutitt, C. M. *Clinical Psychology.* New York, Harpers, 1936.

which may well be due to different standards of judging articulatory defects among the negroes.

TABLE 4

RACE DIFFERENCES

Type of School	Enrollment	Number of Defects	Per Cent
White	174,842	5,708	3.26
Negro	10,850	330	3.04
Mixed	19,007	450	2.36

Incidence by grades.—The data of Tables 1 and 2 show the decrease in incidence of defects with increasing grade. In Table 5 are presented the percentages for city and county schools combined.

TABLE 5

CHANGE IN INCIDENCE WITH GRADE[6]

Grade	Articulatory	Stuttering	Total
New I	8.92	.93	9.85
I	7.34	.73	8.07
II	5.76	.97	6.73
III	4.22	.80	5.02
IV	3.10	.88	3.98
V	2.19	.81	3.00
VI	1.75	.75	2.50
VII	1.44	.80	3.24
VIII	1.10	.62	1.72
IX	.52	.69	1.21
X	.52	.66	1.18
XI	.36	.39	.75
XII	.31	.41	.72

Among children in the first grade for the first time there were practically 10 per cent reported as having some speech difficulty. The percentage decreased steadily until among high school seniors there was reported only 0.7 per cent with defects. The incidence was only one-half of the first grade figure in the third grade, and one-quarter of that figure in the sixth grade. By the ninth grade the incidence was again reduced approximately one-half, while in the twelfth grade the incidence was one-half of that in the ninth grade. Thus it is evident that of school children who start the elementary grades with defective speech, about one-half improve during the first three grades, one-half of the remainder during the next three grades, etc. Apparently the major portion of this improvement comes entirely from casual classroom contacts because very little special attention is being paid to the problem. Practically all of the decrease is due to improvement in articulatory defects. This decreases about nine per cent among children in the new first grade

[6]From Table LXII in Loutitt, C. M. *Clinical Psychology.*

to about one-third of one per cent among high school seniors. Stuttering, on the other hand, shows a very slight decrease throughout the grades. When only children with defects are considered this difference in the two types is even more evident. Among new first-graders who exhibit speech defects 90.5 per cent have articulatory difficulties and only 9.5 per cent are stutterers, while among high school seniors 44.3 per cent have articulatory defects and 55.7 per cent are stutterers.

Subnormal classes.—Reports were received from 20 ungraded classes for subnormals with a total pupil population of 620, of which 392 were boys and 228 were girls. It is immediately evident from Table 6 that speech defects of both types are very much greater

TABLE 6

INCIDENCE OF DEFECTS IN CLASSES FOR SUBNORMALS

	Articulatory			Stuttering			Total		
	B	G	T	B	G	T	B	G	T
Number	22	16	38	12	8	20	34	24	58
Per cent	5.62	7.00	6.13	3.06	3.50	3.22	8.67	10.5	9.35

in the subnormal classes than in the regular grades. Articulatory defects are as frequent among the children in these classes, which represent a wide range of chronological ages, as they are among new first graders; they are nearly 2.5 times as frequent as the total incidence for city schools. Rather unexpectedly stuttering was reported in over 3 per cent of the subnormal children or four times as frequent as in the regular grades.

SUMMARY

1. This questionnaire survey of speech defects among Indiana school children included a total pupil population of nearly 200,000, which is nearly 30 per cent of the total school population.

2. The incidence of reported defects for the total group was 3.7 per cent. In rural schools the incidence was 4.3 per cent and in city schools 3.3 per cent. The gross incidence by type of defects showed 2.93 per cent articulatory disorders and 0.77 per cent stutterers.

3. Sex differences indicated a much greater incidence of defects among boys. There was no real difference between the incidence of white and negro children. Children of subnormal intelligence as shown by attendance in special classes had about three times as many defects.

4. The incidence of articulatory defects decreased steadily from the first to the twelfth grade, while the percentage of stutterers shows a very slight decrease. Relative to the total number of defects stuttering showed a very great comparative increase in the upper grades.

POSSIBLE RELATIONSHIP BETWEEN STUTTERING AND ENDOCRINE MALFUNCTIONING

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Submitted through the interest of Dr. J. F. Bender, Director of the Speech Correction Clinic, College of the City of New York

Among the many theories offered as a part or whole explanation of the speech disorder we term stuttering, is the theory that it is more or less closely related to some mal-functioning of the endocrine system.

The purposes of this study were: (1) to determine whether there is any scientifically adduced evidence tending to indicate a definite relationship between endocrine pathology and stuttering, (2) to obtain information as to the use and effects of endocrine therapy in cases of stuttering, and (3) to obtain the opinions of a number of well-known investigators and practitioners in the field of endocrinology in regard to this problem.

The following questionnaire was sent to thirty-six men prominent in the field.

1. Have you ever used endocrine therapy for the treatment of stuttering or stammering? If so, in approximately how many cases?
2. What was the nature of this therapy?
3. About how many of the patients you have treated (question 1) do you consider to be improved? How many cured?
4. Was the endocrine therapy the only treatment employed for the disorder? If not, in how many of the cases were additional means of treatment used, such as the patient's attending a speech correction clinic, or psychiatric treatment? Of these latter cases, how many were improved? Cured?
5. Would you kindly state, at whatever length suits your convenience, any theories you may hold as to the possible or probable relationships between glandular malfunctioning and stuttering?

Twenty-nine of the thirty-six persons to whom the questionnaire was sent, replied. Of these twenty-nine replies, ten had no experience in this field and did not feel they could contribute an opinion. Amongst this group were research workers in the field of endocrinology, including Doctors Banting, Cannon, H. Jensen, J. J. Abel, Leo Loeb, and B. O. Barnes.

Of the remaining nineteen replies, thirteen were negative, ranging from doubt of any relationship existing between the two disorders, to a rather certain feeling that there was none. The other six ranged in content from the relation of certain experiences in this field which might be of some significance, to one reply expressing the opinion that there is a causal relationship between thyroid and stuttering.

The thirteen negative replies were the following:

1. Dr. A. A. Werner, St. Louis: "I have no proof that stuttering per se has any direct relationship to endocrine disorder. That it may and does occur in children having glandular disorder has been noted in a few instances."
2. Dr. A. C. Ivy, of Northwestern University, writes: "I know of no scientific basis for the existence of a direct relationship between the endocrine glands and stuttering. They may indirectly influence *speech* by speeding up or slowing down cerebral processes or by effecting the irritability of muscles concerned in phonation and speech. The detection of metabolic deficiencies and correcting them would only facilitate the amelioration of stuttering in very much the same way as improving nutrition would, in my opinion."
3. Dr. Leonard G. Rowntree, of the Philadelphia Institute for Medical Research, states: "I have never used any product directly for stuttering or stammering. I have used occasionally various endocrine products where stammering has been present, but I have never seen anything at any time that I considered very definite in the way of an influence from an endocrine product on stammering."
4. Dr. Elias Mazer, of the University of Pennsylvania, reports that he is interested in endocrinology purely from the standpoint of a gynecologist, but that he was " . . . a general practitioner for many years and from my recollection of the cases of stuttering I encountered during the many years of general practice none showed definite evidence of endocrine disturbance."
5. Dr. W. W. Swingle, of Princeton University, states: "I do not know of any well established work indicating a relationship between endocrine disturbance and stammering."
6. Dr. Oscar Riddle, of the Carnegie Institution of Washington, writes: "I treat no patients; I am an investigator. I know of no satisfactory evidence that stuttering is based upon any endocrine disturbance."
7. Dr. R. G. Hoskins, of the Harvard Medical School, says: "I should be quite surprised were any significant correlation to turn up between stuttering and glandular malfunction. At any rate I know of no evidence pointing toward such a relationship."
8. Dr. E. C. Kendall, of the Mayo Clinic, reports: "So far as I know, no treatment with any endocrine product has been shown

to be beneficial in the condition of stammering. We do not have a record of any cases treated in the Mayo Clinic and I know that it has not been used in any work carried out at the University of Minnesota."

9. Dr. J. M. Rogoff, of the University of Chicago, writes:

"I can reply only to the last of your questions. In my opinion, the fundamentals of endocrine physiology and pathology are too inadequately established to permit correlation of any present knowledge of them with the disturbances which underlie defective speech. Certainly no rational basis exists for treatment with endocrine products.

"From the extensive literature on endocrinology, I am convinced that not only 'stuttering' but much 'sputtering' has come out of the endocrines. Personally, it has led to considerable 'muttering.'

"I have no doubt that you will be able to obtain information on endocrine therapy in stuttering. Empirical practices are only too common in the field of endocrinology. However, I might suggest that statistical treatment of data lacking in substantial fundamentals of physiology and pathology may be confusing."

10. Dr. E. C. Dodds, of the Middlesex Hospital Medical School, London, replies: "I cannot conceive how any endocrine therapy can have any effect whatsoever on stammering or stuttering. I have never heard of the use of any endocrine production for this purpose and therefore regret that I cannot help you."

11. Dr. H. B. Richardson, of the New York Hospital (Cornell Medical Center), states: "Such a relationship seems highly improbable and hardly worth studying. I recall no patient in the Endocrine Clinic at the New York Hospital during the past three and one-half years who stuttered. I should question the value of positive answers to questions 2, 3, and 4, if you get any."

12. Dr. Harvey Cushing, of Yale Medical School, says: "No relationship."

13. Dr. Irving Pardee, of the Vanderbilt Clinic, Columbia-Presbyterian Medical Center, New York, says: "There is none."

The remaining six replies, some of which report experiences which may be suggestive for further study, are:

1. Dr. E. Perry McCullagh, of the Cleveland Clinic, replies: " . . . I have had little experience with endocrine therapy in this regard and have not investigated a sufficient number to warrant conclusions. You may be interested to know, however, that in the course of treating two cases of hyperinsulinism it was found that hypoglycemic intervals were accompanied by considerable stuttering, which cleared up completely on the use of a low carbohydrate fat diet with frequent feedings and the accompanying elevation in blood sugar levels."

2. Dr. Harry Benjamin, of New York City, reports some experience in reply to question one, with improvement doubtful, and additional treatments used at the same time as the endocrine product was being administered. Dr. Benjamin states: "In spite of some theories, there is no definite relationship known between glandular disorders and stuttering. It seems logical to me that especially those cases of stuttering that do not respond promptly to psychological and exercise treatment should be examined for glandular disorders on general principles and if such disorders are found they should be corrected if possible. From a theoretical point of view I believe that stammering may go together with an under-development of the sex gland chain (which often causes an inferiority feeling) and the respective endocrine treatment may facilitate other efforts made on behalf of the patient."

3. Dr. Murray B. Gordon, of the Long Island College of Medicine, New York City, advises that he has never been able to obtain any improvement in stammering by the use of thyroid extract, administering doses varying from gr. 1-10 to 1 t. i. d. He adds:

   "Stammering may occur as a manifestation of an increased irritability and part of a generalized nervous excitation produced by thyroid therapy, when given beyond the point of tolerance. In the American Journal of Medical Sciences, *175*: 360, 1928, I reported five cases of childhood myxedema and hypothyroidism in children in which stammering occurred during the course of thyroid treatment. I considered it as a manifestation of a general nervous excitation following disturbance of the central nervous system. The stammering disappeared on discontinuing the thyroid extract and reappeared on its resumption."

4. Dr. George B. Dorff, of Bellevue Hospital, New York City, in referring to his experiences in treating children suffering from hypothyroidism, says:

   "Some of these patients who stutter or stammer at times improve under thyroid therapy. At other times, too much thyroid medication (perhaps due to too much cerebral stimulation) seems to exaggerate the stammer or stutter.

   "In a general way, it is my opinion at the present time that stammering, stuttering and certain speech defects are associated in a number of children with a marked insufficiency of the thyroid gland. This shortcoming in speech may be part of the developmental retardation usually associated with hypothyroidism. This, of course, does not mean that all cases with speech defects are suffering from thyroid insufficiency. I have noted no such defects in any other endocrine condition in children."

5. Dr. Harry A. Solomon, of Bellevue Hospital, writes:

   "Two cases of stuttering occurred in a group of twenty congenital thyroid insufficiency (cretin) cases. In no other form of

endocrine dycrasia have I ever noted this defect. In adult hypothyroidism (myxedema), primary or secondary, slowness of speech, jumbling and difficulty in pronouncing words is a constant feature. This is due to the disturbed function of the nervous system when deprived of the stimulating influence of a specific hormone, thyroxin.

"In the congenital cases no benefit was observed in speech by thyroid therapy, although practically all other changes were improved. In myxedema under thyroid administration improvement in speech was striking in all cases in from two to four weeks after the medication was started."

6. Dr. Lawrence Kuskin, of the Israel Zion Hospital, Brooklyn, New York City, replies:

"My experience in endocrine studies has been limited to a few cases that occurred in the treatment of myxedema. These cases were receiving dessicated thyroid therapy and stuttering manifested itself during the course of the treatment. When the thyroid was withdrawn, stuttering stopped. With the resumption of the treatment, stuttering was induced, so that I feel there is a definite causal relationship between thyroid and stuttering.

"In these instances, it is my belief that the accelerated metabolism was a sufficient stimulation to cause this speech disorder. I feel that an endocrine study should be made in all cases of stuttering, as well as a general physical examination, in order to rule out possible hyperthyroidism or any other glandular imbalance."

An interesting angle on the report of Doctors Gordon, Dorff and Kuskin, who observed that stuttering sometimes occurs after thyroid administration, or in other words when too much of the hormone was present, is furnished by Dr. Solomon. Dr. Solomon noted "slowness of speech, jumbling and difficulty in pronouncing words" as a constant feature in myxedema, and believes this to be due to "the disturbed function of the nervous system when *deprived* of the stimulating influence of the specific hormone, thyroxin." This seeming contradiction of too much stimulation from thyroxin causing stuttering, and on the other hand slowness of speech being caused by insufficient stimulation, may not really be a contradiction at all, because the symptoms observed are not identical. The difficulty in pronunciation reported by Solomon in cases of myxedema seems to be a quite different symptom from the stuttering sometimes manifested by the temporarily nervous and excited patient who has just received a dose of thyroid.

A further question which suggests itself in considering the observations of Gordon, Dorff and Kuskin, is why we do not find stuttering more frequently associated with *hyper*thyroidism if the presence of too much thyroxin in the blood stream tends to stimulate cerebral

processes to the extent of inducing stuttering. In reply to this question, Dr. Dorff writes: "In regard to . . . stuttering in hyperthyroidism, I might state that the latter condition occurs almost exclusively in adults, and therefore in mature individuals, in whom the cerebral patterns have been laid down and fixed and are much more difficult to modify than in the child in its formative stage. Hyperthyroidism is rare in children though it may occur. Although limited somewhat in my experience with adults I do not recall stuttering in any case of hyperthyroidism in an adult."

We might reasonably advance a different hypothesis from the one Dr. Dorff suggests above to account for the fact that stuttering is not observed in cases of hyperthyroidism, while it is observed in some cases when dessicated thyroid is administered to hypothyroid cases, temporarily changing their hypo condition to hyper. In the hyperthyroid case, such as Grave's disease, the condition is more or less chronic. Consequently, the patient tends to build up a constitutional tolerance to the hormone which is greater than normal, and so is not so disturbed and does not stutter. But in myxedema the patient or the organism-as-a-whole tends to adjust to a subnormal supply of thyroxin in the blood, with the result that the cerebral processes show marked disturbance upon the sudden increase in metabolism occasioned by the administration of the thyroid.

Dr. Solomon's observation that "in myxedema under thyroid administration, improvement in speech was striking in all cases in from two to four weeks after medication was started," seems very significant, and something very much worth checking under controlled experimental conditions. In these cases, however, we are observing a general improvement in nervous response and nervous irritability, so that jumbled speech will naturally tend to improve as the brain areas, including those apparently most concerned with articulation, approach a return to normal function and normal irritability.

Turning back to Dr. McCullagh's observation that stuttering occurred in two cases of hyperinsulinism when the patient was deprived of the normal supply of glycogen in the blood, we see further evidence of the inter-relation of the endocrine glands in their effect on the central nervous system as well as the sympathetic system. Dr. W. Park Richardson, chief of the medical division of the College of the City of New York, has noted that during periods of apprehension in the course of routine medical examinations, some students tend to stutter, with concomitant elevation of blood pressure. In an experimental study conducted at Stanford University Medical School some fifteen years ago, Dr. Richardson found that epinephrine injections into women whose ovaries had been removed caused apprehension, tremors of extremities, difficulty in respiration, and difficulty in speech, resulting in temporary stammering or stuttering. The same effects from the epinephrine injections were

noted in women whose ovaries had not been removed, but not to so marked a degree. This would suggest that any excitation of the sypathetic nervous system, which in turn affects the central, or a sudden excitation or depression of the central nervous system directly, may cause "nervous shock" and thus affect the speech areas, disturbing their normal function with consequent interference with articulation.

The foregoing may contribute something to an understanding of what takes place in the physiology of the nervous system in cases of stuttering that seem to have their genesis in some childhood fright or nervous shock, or in the cases of stuttering which have sometimes been observed to appear after whooping cough, scarlet fever, intestinal troubles, etc. In the case of the illnesses mentioned, a condition of exhaustion is generally present, which may facilitate conditioning, and this may account in some cases at least for the stuttering prevailing after the patient has recovered from the shock or state of exhaustion.

Some empirical evidence is presented for this point of view in an article by Kleitman and Titlebaum[2] in the American Journal of Physiology, Vol. 15, No. 1, March, 1936. The summary and conclusions of their work are herewith quoted:

"In five dogs trained to distinguish a metronome frequency of 100 beats per minute from a higher one, by 'reinforcing' the former and not the latter, the difference between the positive and negative frequencies was gradually narrowed down to a point where differentiation was no longer perfect. Under these conditions the influence of thyroid upon the differentiating ability was studied by alternating two-week periods of daily oral administration of thyroid in 2.0 gram doses with two-week control periods. There was improvement in the percentage of correct responses to the positive and negative conditioned stimuli during thyroid periods, and a slump in the subsequent control periods. There was also an increase in magnitude of conditioned as well as unconditioned responses during thyroid periods."

If this holds true for humans as well as dogs, then it would seem that a conditioned stuttering would be increased in magnitude during periods when cerebral processes were speeded up such as occur upon the administration of thyroid, shock, *or conditions of internal subjective apprehensiveness, where the glands may be stimulated through psychological influences upon the sympathetic nervous system, with consequent effect upon cerebral processes.*

Finally, we may quote a letter from Dr. Benjamin, in response to our request for comment on the observations recorded in the six replies of this group we are now considering. He writes:

"The greatest difficulty, as I see it, in correlating the apparently

[2]Conducted under the direction of Dr. James F. Bender, director of the Speech Correction Clinic, College of the City of New York.

contradictory findings of various endocrinoiogists regarding thyroid medication and stuttering, is the necessity of excluding psychological influences which may have occurred at the time of the thyroid medication. Furthermore, the thyroid acts so often indirectly through its influence on other glands that the occurrence or disappearance of stammering may have no direct, but only an indirect, connection with the thyroid medication or its withdrawal. Nobody can deny of course that the central nervous system is subject to hormonic influences. But which hormone is responsible in a given case is just as obscure as the manner in which it acts. Furthermore the functions of the central nervous system may be subject to allergic influences and although I am far from predicting it, I do not consider it impossible that stammering may be linked some day with allergy and treated accordingly. The close connection between the so-called allergy and endocrine functions is of course well known.

"I am inclined to link stammering more with the sex hormone (either the unspecific one of the pituitary or the specific ones of the testes or ovaries) than with any other hormone. I clearly remember one case of a young man in whom stammering occurred or increased whenever his sex functions were unsatisfactory. But whenever he met the right party and had successful and satisfying sex relations (sometimes following gonadal treatments) stammering almost disappeared as long as he was under the psychological influences of his success 'in venere.' The gonadal hormone may or may not have had a direct bearing on this result. Who would know at present?

"In any event it seems logical to me, from observations so far available, to connect the disappearance of stammering with a disappearance or decrease of an inferiority feeling.

"I am sorry I cannot give you any more specific explanations and information but I believe all you can possibly accomplish at the present time is to create more interest in this particular subject and therefore invite more *exact* observations and possibly more plausible explanations in the future."

SUMMARY AND CONCLUSIONS

Twenty-nine prominent endocrinologists replied to a questionnaire which attempted to ascertain whether in their researches or experiences, they found anything which might be of significance toward establishing a relationship between endocrine malfunctioning and stuttering.

No one presented any scientifically adduced evidence which would tend to show a definite causal relationship betewen endocrine pathology and stuttering.

Four of the replies mentioned experiences to the effect that "stammering may occur as a manifestation of an increased irritability and part of a generalized nervous excitation produced by thyroid therapy, when given beyond the point of tolerance."

Stuttering which is sometimes observed in cases of cretinism, or childhood hypothyroidism, may be "part of the developmental retardation usually associated with hypothyroidism."

No scientifically adduced evidence was reported which would warrant the conclusion that glandular treatment of childhood hypothyroidism will result in an improvement in stuttering, in cases where the two happen to go together. One endocrinologist did report such improvement in some cases of this type, but we cannot be sure that it was due to the glandular treatment per se.

One reply, by the chief of the Endocrine Clinic of Bellevue Hospital, reports that "in myxedema under thyroid administration, improvement in speech was striking in all cases in from two to four weeks after medication was started." It is unknown what other factors may have been operative, but if the improvement occurred in *all* cases, and "all" represents a significant number, then it would seem that the central nervous system is markedly subject to hormonic influences, and that the areas usually associated with articulation are sensitive to these hormonic influences on the central nervous system.

An experimental study with dogs indicated that conditioned activities are facilitated by thyroid medication. In those cases where stuttering may primarily represent conditioning, the stuttering may tend to be increased in magnitude under glandular stimulation, such as by thyroid administration, which speeds up cerebral processes generally.

Stimulation of the sympathetic nervous system, as by the administration of epinephrine, may occasion stuttering. Since the sympathetic nervous system is particularly subject to psychological stimuli, it might be inferred that feelings of inferiority, shock, apprehension, or internal subjective factors may likewise stimulate this sympathetic system so that in some cases it will affect cerebral processes and tend to make the individual susceptible to stuttering.

NEWS

The International Society for Logopedy and Phoniatry held its 7th Congress in Copenhagen, Denmark, August 10th to 12th. It is unfortunate that a strong representation from our own membership could not have been present. Particular stress was placed this year on cleft palate speech.

The German Society for the Voice and Speech Correction Profession met this year from the 20th to 22nd of August, in Berlin.

Professor Knight Dunlap, who is so well known for his many contributions pertaining to speech disorders, resigned his position as chairman of the department of psychology at Johns Hopkins University, to take that of chairman in the University of California at Los Angeles.

South Africa announces its large university will join those of the other leading nations of the world in opening a speech clinic in connection with its courses in phonetics.

Dr. Jack C. Cotton has been appointed to a position at Ohio State University, Columbus, Ohio, and will assist Prof. M. K. Mason, who is assistant director of the speech clinic. As this issue goes to press they are preparing for the annual speech and hearing examination of between the 3,000 and 4,000 new students who each year enter the university for the first time.

Dr. Charles Van Riper has been called to open up a clinic and take charge of such speech work at the Kalamazoo State Teachers College, Kalamazoo, Michigan.

Mrs. Elizabeth McCaughey Fruewald, formerly of the Speech Clinic staff at Ohio State University, has gone west by reason of the health of one of the members of her family. She expects to open up a private clinic, dealing with both speech and hearing cases. She made a fine reputation in clinical psychology, and as a former instructor at the Ohio State School for the Deaf following her training on a scholarship at Central Institute, St. Louis.

Dr. Robert O. L. Curry, of Armstrong College, Durham University, England, is to spend his second year at Ohio State University, Columbus, Ohio, on a synchronized oscillographic x-ray study carried out through a fellowship from the Commonwealth Foundation.

Frank Bakes, so well known in Columbus, Ohio, by reason of his outstanding work at the Ohio State Bureau of Juvenile Research, has taken a year's leave to pursue a research problem at the University of Iowa under Dr. Lee Travis.

Edward Weston, well known inventor and manufacturer of electrical instruments widely used in this field, died August 20, age 86.

The Leverhulme Committee on fellowships and aid of research for Great Britain announces award among others of a grant to C. W. Valentine, M.A., Lond., D. Phil., St. Andrews, professor of education, Birmingham University, for research on the psychology of early childhood.

Yale University announces that Dr. Leon Ectors, of Brussels, has received an award from the Commission for Relief in Belgium Educational Foundation for continuation of research on the autonomic functions of the cerebral cortex.

Dr. Robert S. Turner will continue his study of electrical changes in the nervous system associated with functional disorders, on a Knight Fund fellowship at Yale University, under the direction of Dr. Harold S. Burr.

Dr. S. A. Peoples, former fellow in Maudsley Hospital, London, and Dr. P. K. Knoefel, are continuing a study of depressants on the central nervous system carried on at the University of California in San Francisco.

Dr. Charles Gilbert Chaddock, former professor of diseases of the nervous system at St. Louis University, died on July 20, age 74.

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THE ANTIQUITY OF SPEECH SCIENCE SYMBOLS

The oldest technical symbols still used by scientists are our phonetic characters. They are, for example, far older than any chemical symbols. Both groups have been added to and modified as our body of knowledge changed and increased and as the years passed by. But in their essentials, technical phonetic symbols have been used by scientists the world over with their present values for more than 2000 years.

m, n, t, θ and k are even much older than that. The m stands for the labial hum. The n for the point-lingual hum. The t for the point-lingual unvoiced stop. The θ for its corresponding fricative. And the k for the unvoiced velar stop.

Scientists use the vowels i, e, a, o, u, with the basic Latin pronunciation values given them at the time of Christ rather than the chaotic values used by the American layman (cf. **at**, **calm**, **ball**, **bathe**). Those Latin values give us a metallic higher pitched ah for a rather than our more common muffled lower pitched Standard American midwestern vowel in **calm** represented by scientists with a script ɑ.

The ɪ, ɘ, ʊ, ɛ, ɔ, æ, ʌ, and ɚ, have been, to say the least, so thoroughly established with their present values during the last century, that they are understood the world over, even tho the layman may find their appearance strange.

p, b, f, v, s, z, g (with its so-called "hard" sound alone accepted), and h, are likewise well over a thousand years old and are fairly free from confusing variation usually resulting from popular usage of technical symbols. The Greek lower case delta and ð are equally old, and while some voiced-unvoiced interchange was current in the oldest English usage of these as well as of the "thorn", that interim of confusion long ago ceased to exist. ʃ is an old symbol, but like ʒ and ʤ may be said to have only had its present acoustic connotation thoroughly established within the last century. ŋ is a symbol which was created about that time and is now quite as precisely understood by scientific investigators of all nationalities.

Such technical symbols have had their present values among scientists of every age, as far back as we can trace them. And they still retain them today. In other words, they have as exact and universally understood a meaning as O for oxygen, H for hydrogen or H_2O for water among chemists.

TO AUTHORS.

Authors referring to sounds, in articles submitted for publication in this Journal, are requested to confine themselves to the following conservative scientific symbols, most of which are thousands of years old, and almost universally used. So our colleagues the world over know exactly what they mean. Besides if we avoid our own and other (even I.P.A.) strange symbols of the last few decades, costs to both author and journal are reduced.

All of the illustrations used below assume norms as widely pronounced in Standard American:

a	(night) First element in diphthong a ɪ, or as heard in "Spanish **a**"		
e	(**m**ain, th**e**y, f**a**te)	m	(**m**at, **m**en, sla**m**)
i	(pol**i**ce, s**ee**n, l**ea**n)	n	(**n**et, spi**n**, pe**nn**y)
o	(**o**bey, r**oa**st, n**o**)	ŋ	(si**ng**, dri**nk**, wi**ng**)
u	(r**u**le, p**oo**l, pr**u**de)	l	(**l**amb, a**ll**y, a**ll**)
ɪ	(b**i**t, kn**i**t, gr**i**n)	r	(**r**ed, v**a**ry, ch**air**)
ɛ	(m**e**t, m**a**ny, b**e**d)	j	(**y**ear, **o**nion, **y**our)
æ	(h**a**t, bl**a**ck, c**a**tch)	w	(**w**ait, **o**we, **w**ord)
ɑ	(c**a**lm, h**a**rd, sh**o**t)	ʍ	(**wh**ip, **wh**y, **wh**ich)
ɔ	(cl**o**th, **o**ff, c**ough**)	v	(**v**ase, Sla**v**, **o**ver)
ɔ	(h**a**ll, b**aw**l, m**o**ss)	f	(**f**or, ro**ugh**, pu**ff**y)
ə	(**a**bove, id**ea**, th**e**)	ð	(**th**e, oa**th**s, **o**ther)
ʌ	(n**u**n, s**o**me, l**u**ck)	θ	(**th**in, la**th**, pi**th**y)
ʊ	(f**oo**t, p**u**sh, p**u**t)	z	(**z**one, bu**zz**, bus**y**)
ɜ	(b**ir**d, b**ur**n, f**er**n)	s	(**s**o, pa**ss**, mi**ss**y)
b	(**b**oy, cra**b**, lo**bb**y)	ʒ	(rou**ge**, plea**s**ure)
p	(**p**an, ho**p**, ha**pp**y)	ʃ	(**sh**y, a**sh**, mu**sh**y)
d	(**d**ay, bu**dd**y, ma**d**)	dʒ	(**J**ohn, a**g**e, a**dj**oin)
t	(tro**d**, hun**t**, pi**t**y)	tʃ	(**ch**ap, i**tch**, **ch**op)
g	(**g**et, bra**g**, bu**gg**y)	h	(**h**ere, a**h**oy, **h**urt)
k	(**c**all, wal**k**, a**c**me)	ʔ	(= a glottal plosive)

˜ (over = nasality) ˛ (under = a fricative)